

Example 44-3.1

Given: $G_1 = -1.75\%$
 $G_2 = +2.25\%$
Elev. of PVI = 176.000 m
Station of PVI = 3 + 860.00
L = 160 m

Problem: Compute the grade for each 20-m station. Compute the low point elevation and stationing.

Solution:

1. Draw a diagram of the vertical curve and determine the station of the beginning (PVC) and the end (PVT) of the curve.

$$\text{Beginning Station (PVC)} = \text{PVI Sta} - \frac{1}{2}L = (3 + 860) - (0 + 080) = 3 + 780$$

$$\text{End Station (PVT)} = \text{PVI Sta} + \frac{1}{2}L = (3 + 860) + (0 + 080) = 3 + 940$$

2. Find the vertical curve equations:

$$M = \frac{(G_2 - G_1)L}{800} = \frac{[2.25 - (-1.75)]160}{800} = 0.80 \text{ m}$$

$$Z = M \left(\frac{X}{L/2} \right)^2 = \frac{4M}{L^2} X^2 = \frac{4 \times 0.80}{25600} X^2 = \frac{X^2}{8000}$$

Example 44-3.01

Solution: (continued)

3. Set up a table to show the vertical curve elevations at the 20-meter stations:

Station	Inf.	Tangent Elevation	X	X^2	$\frac{X^2}{8000}$	Grade Elevation
3 + 780	PVC	177.400	0	0	0	177.400
3 + 800		177.050	20	400	0.050	177.100
3 + 820		176.700	40	1600	0.200	176.900
3 + 840		176.350	60	3600	0.450	176.800
3 + 860	PVI	176.000	80	6400	0.800	176.800
3 + 880		176.450	60	3600	0.450	176.900
3 + 900		176.900	40	1600	0.200	177.100
3 + 920		177.350	20	400	0.050	177.400
3 + 940	PVT	177.800	0	0	0	177.800

4. Calculating low point:

$$X_t = \frac{LG_1}{G_1 - G_2} = \frac{160(-1.75)}{-1.75 - 2.25} = \frac{-280}{-4.00} = 70 \text{ meters from PVC}$$

therefore, the Station at low point is:

$$(3 + 780) + (0 + 070) = (3 + 850)$$

elevation of low point on curve equals:

$$\text{Elev. PVC} - \frac{LG_1^2}{(G_2 - G_1) 200} = 177.400 - \frac{160(-1.75)^2}{(2.25 - (-1.75)) 200} = 177.400 - 0.613 = 176.787 \text{ m}$$

VERTICAL CURVE COMPUTATIONS

(Example 44-3.1)

Figure 44-3G